Dual band radio receiver

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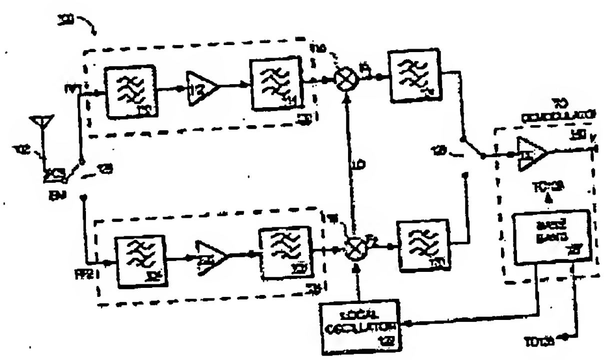
A dual band radio receiver (100) is provided. The dual band radio receiver includes a local oscillator (122) configured to generate a local oscillator (LO) signal. The dual band radio receiver also includes first (16) and second (18) mixer devices. The first mixer device is configured to receive the LO signal and an RF signal included within a first band. Responsive to these signals, the first mixer device outputs a first IF signal. The second mixer device is configured to receive the LO signal and a second RF signal included within a second band. In response to these signals the second mixer device outputs a second IF signal. The local oscillator is configured to operate within a third band located between the first and second bands.



Dual band radio receiver

Claims of corresponding document: **WO9844646**

CLAIMS

What is claimed is: 1. A dual band radio receiver comprising: a local oscillator configured to generate a Local Oscillator (LO) signal; a first mixer device configured to receive said LO signal and a first Radio Frequency (RF) signal included within a first band and responsively to output a first Intermediate Frequency (IF) signal; a second mixer device configured to receive said LO signal and a second RF signal included within a second band and responsively to output a second IF signal; and wherein said local oscillator is configured to operate within a third band located between said first and second bands.

2. The dual band radio receiver of claim 1 further comprising first and second IF filters and a switching device coupled thereto, wherein said first and second IF filters are coupled to said first and second mixer devices respectively.

3. The dual band radio receiver of claim 2 further comprising a control circuit coupled to said local oscillator device and to said switching device.

4. The dual band radio receiver of claim 1 wherein said first band is substantially within approximately a frequency range of 1.910 GHz and 1.930 GHz.

5. The dual band radio receiver of claim 1 wherein said second band is substantially within approximately a frequency range of 2.40 and 2.4835 GHz.

6. The dual band radio receiver of claim 1 wherein said third band is substantially between approximately 2.155 GHz and 2.2385 GHz.

7. The dual band radio receiver of claim 1 wherein said third band is positioned approximately half-way between said first and second bands.

8. A system comprising: a transmitter circuit; and a dual band radio receiver coupled to said transmitter, said dual band radio receiver including
a local oscillator configured to generate an LO signal;
a first mixer device configured to receive said LO signal and a first RF signal included within a first band and responsively to output a first IF signal,
a second mixer device configured to receive said LO signal and a second RF signal included within a second band and responsively to output a second IF signal, and
wherein said local oscillator is configured to operate within a third band positioned between said first and second bands.

9. The system of claim 8 further comprising first and second IF filters and a switching device coupled thereto, wherein said first and second IF filters are coupled to said first and second mixer devices respectively.

10. The system of claim 9 further comprising a control circuit coupled to said local oscillator device and to said switching device.

11. The system of claim 8 wherein said first band is substantially within approximately a frequency range of 1.910 GHz and 1.930 GHz.

12. The system of claim 8 wherein said second band is substantially within approximately a frequency range of 2.40 and 2.4835 GHz.

13. The system of claim 8 wherein said third band is substantially between approximately 2.155 GHz and 2.2385 GHz.

14. The system of claim 8 wherein said third band is positioned approximately half-way between said first and second bands.

band radio receiver configured to receive Radio ... an RF signal into an IF

signal, the method comprising the steps of: a) determining whether said RF signal belongs to one of a first and a second bands; and b) if saidRF signal belongs to one of said first and second bands generating said IF signal by mixing said RF signal with a LO signal belonging to a third band located between said first and second bands.

16. The method of claim 15 wherein said step b) includes the step of: if said RF signal belongs to said first band, driving saidRF signal and said LO signal to a first mixer device.

17. The method of claim 15 wherein said step b) includes the step of, if said RF signal belongs to said second band, driving saidRF signal and said LO signal to a second mixer device.

18. The method of claim 15 wherein said third level is substantially half-way between said first and second bands.

19. The method of claim 15 wherein said first band is substantially within approximately a frequency range of 1.910 and 1.930 GHz.

20. The method of claim 15 wherein said second band is substantially within approximately a frequency range of 2.40 and 2.4835.

21. A method for providing a dual band radio receiver, the method comprising the steps:
providing first and second mixers;
providing a circuit configured to determine whether an RF signal input thereto belongs to one of a first and second bands, said circuit coupling said RF signal to one of said first and second mixers if said circuit determines that theRF signal belongs to one of a first and second bands respectively; and
coupling a local oscillator to said first and second mixers, said local oscillator configured to generate signals within a third band that is positioned approximately mid-way between said first and second bands.

Dual band radio receiver

Description of corresponding document: **WO9844646**

Dual Band Radio Receiver

FIELD OF THE INVENTION

The present invention relates to the field of communication devices. More particularly, the present invention relates to radio receivers.

BACKGROUND OF THE INVENTION

Radio receivers are well known in the art. Typically, a radio receiver intercepts radio frequency (RF) signals by way of an antenna that is coupled to a front end of the radio receiver. The front end of a radio receiver typically includes one or more filters and low-noise amplifiers that receive incoming RF signals. Since signal processing is less complicated for signals at lower frequencies,RF signals are typically down-converted by a mixer before being processed.

Typically, a mixer receives theRF signal to be down-converted and a signal from a local oscillator device (LO) that may have a frequency lower than the frequency of the RF signal. In response to these signals, the mixer produces an intermediate frequency (IF) signal that may further be driven to an IF filter from where a filtered IF signal may be driven to a demodulator, signal processing unit, etc.

The IF signal has an amplitude proportional to the amplitude of the RF signal and a frequency typically lower than the frequency of the RF signal. In most radio receivers, the frequency of the IF signal is proportional to the difference between the frequency of the RF signal and the frequency of the local oscillator device.

A dual band radio receiver is a receiver configured to receive signals belonging to two frequencies ranges (bands). For example, in certain multimedia applications, signals belonging to two bands such as data and voice signals may be transmitted intermittently to a dual band radio receiver. The dual band radio receivers that are typically utilized in these applications require two local oscillators, one for each band. Additionally, such dual band radio receivers may require two IF processing devices such as demodulators, amplifiers, signal processors, etc. These dual band radio receivers are expensive due to the utilization of two local oscillators and two IF demodulation stages.

It is desirable to provide a dual band radio receiver at reduced cost. It is also desirable to provide a dual band radio receiver that allows quick switching of a local oscillator device between two high frequency bands that are relatively close to each other.

SUMMARY OF THE INVENTION

The present invention provides a dual band radio receiver.

The dual band radio receiver includes a local oscillator configured to generate a local oscillator (LO) signal. The dual band radio receiver also includes first and a second mixer devices. The first mixer device is configured to receive the LO signal and an RF signal included within a first band. Responsive to these signals, the first mixer device outputs a first IF signal. The second mixer device is configured to receive the LO signal and a second RF signal included within a second band. In response to these signals the second mixer device outputs a second IF signal. The local oscillator is configured to operate within a third band located between the first and second bands.

BRIEF DESCRIPTION OF THE DRAWINGS

The features, aspects, and advantages of the present invention will become more fully apparent from the following Detailed
Description, appended claims, and accompanying drawings in which:
Figure 1 illustrates a block diagram showing a dual band communication device according to the present application.

Figure 2 illustrates a diagram showing the positions of the first, second, and third bands in connection with the dual-band communication device according to the present invention.

Figure 3 illustrates a block diagram showing a local oscillator in connection with the dual-band radio receiver according to the present invention.

... according to the present

invention.

Figure 5 illustrates a flow chart diagram in connection with a method for converting a RF signal into an IF signal in a dual band radio receiver according to the present invention.

Figure 6 illustrates a process for providing a dual band radio receiver according to the present invention.

DETAILED DESCRIPTION

In the following description, numerous specific details are set forth to provide a thorough understanding of the present invention.

However, one having ordinary skill in the art should recognize that the invention can 'be practiced without these specific details. In some instances, well-known circuits, structures, and techniques have not been shown in detail to avoid unnecessarily obscuring the present invention.

Figure 1 illustrates a block diagram of a dual band communication device 100 according to the present invention. In the embodiment according to the present invention described herein, the dual band communication device 100 is implemented as a radio receiver but the present invention is not limited in scope to a radio receiver. Dual band radio receiver 100 includes an antenna 102 that typically receives RF signals at a high frequency. In the embodiment described herein, dual band radio receiver 100 receives signals transmitted within PCS and the ISM frequency ranges. Signals within the PCS frequency range may be used for voice communication (telephony) and include signals with frequencies in the range of approximately 1.910-1.930 Gigahertz (GHz) (hereinafter "first band").

Signals within the ISM frequency range may be used for video communication and include signals with frequencies in the range of approximately 2.40-2.4835 GHz (hereinafter second band"). Dual band radio receiver 100 according to the present invention, however, is not limited to the reception of signals within these two frequency bands.

Dual band radio receiver 100 further includes a switching device 126 coupled to antenna 102 and configured to be coupled to one of a first and second front end receivers 132 and 134 respectively shown in dotted line. Switching device 126 is controlled by a base band controller 127 and is configured to selectively couple a RF signal intercepted by antenna 102 to one of the first front end receiver 132 and second front end receiver 134 depending on whether the RF signals frequency is within the first or the second band.

Front end receivers 132 and 134 may be conventional front end receivers known in the art. First front end receiver 132 includes a first band-pass filter 110, a low-noise amplifier 112 and a second band-pass filter 114 but the present invention is not limited in scope to these devices. The first band-pass filter 110 rejects frequencies outside 1.9101.930GHz. Low-noise amplifier 112 provides reverse isolation that reduces radiation back to the antenna 102 and boosts the gain. Second band-pass filter 114 also rejects frequencies outside 1.910-1.930GHz.

Second front end receiver 134 includes band-pass filters 104 and 108 and low-noise amplifier 106 coupled therebetween. These devices work in a substantially similar fashion as devices 110, 112 and 114 with the exception that band-pass filters 104 and 108 reject frequencies outside 2.40-2.4835 GHz.

After an RF signal has passed through one of the first front end receiver 132 and second front end receiver 134, the RF signal is coupled to an RF input of one of first mixer device 116 and second mixer device 118, respectively. First and second mixer devices 116 and 118 are conventional mixers with appropriate filtering. A local oscillator device 122, which may be part of a radio's synthesizer circuit, that is known in the art, is coupled to both the first and second mixer devices 116 and 118. The local oscillator device 122 produces a local oscillator signal (LO) and drives this signal to both a local oscillator input of first mixer device 116 and a local oscillator input of second mixer device 118. First and second mixer devices 116 and 118 are configured to mix the local oscillator signal with the respectiveRF signals input to one of the mixer devices 116 and 118, thereby producing one of a first and second intermediate frequency signalsIF1 and IF2 respectively.

Signal IF1 has a frequency substantially equal to a frequency difference between the RF1 signal and the LO signal while signal IF2 has a frequency substantially equal to a frequency difference between the RF2 signal and the LO signal. The resulting first and second IF signals are then fed to IF filters 124 and 120 respectively where these signals are further filtered according to the particular receiver's design specification. Mixer devices and their operation are well known in the art.

... second signals IF and IF2 may then be selectively coupled to back end circuitry 140

(shown in dotted line) by way of a second switching device 128. The back end circuitry may be utilized to amplify and demodulate one of the first and second IF signals. Second switching device 128 selectively couples, depending on a control signal generated by base band controller 127, one of the first and second IF signals to an IF amplifier 130 of back end circuitry 140. The resulting IF signal output by the IF amplifier 130 may be driven to a demodulator (not shown).

Local oscillator device 122 is configured to operate within a third frequency band which is positioned between the first and the second bands. The third band is substantially narrow (approximately 80 MHz). In this way, local oscillator device 122 operates as highside injection for the first band and as lowside injection for the second band. In one embodiment according to the present invention local oscillator device 122 may have its frequency band (third band) positioned substantially mid-way between the centers of the first and second frequency bands. This arrangement ensures that the output IF frequency bands of the first or second IF signals are substantially the same whether the IF signal is derived from the first or second bands.

In this way, a single local oscillator IF unit and demodulator circuit can be used for signals belonging to both the first and second bands.

Hence, the dual band radio receiver according to the present invention may be provided at a lower-cost since only one local oscillator and one back end circuitry need be included therein.

In the embodiment according to the present invention described herein, the first band is defined by a first frequency range of 1.910 GHz to 1.930 GHz, and the second band is defined by a second frequency range of 2.40 GHz to 2.4835 GHz. The local oscillator device 122 is configured to operate at frequencies within a third band, that are above the range of 1.910-1.930 GHz but below the range of 2.40-2.4835 GHz. The third frequency band, within which the local oscillator may operate, is positioned substantially half-way between the first and second bands. The frequencies which define the third band can be calculated in the following way. The difference between the lowest frequencies of the second and first band is equal to (2.40 GHz - 1.910
GHz) which is equal to 490 MHz. A lower local oscillator frequency comprising the lower limit of the third band may be calculated according to the formula: 1.910 GHz +490 MHz = 2.155 Ghz
2
An upper local oscillator frequency including the upper limit of the third band may be calculated according to the formula: 2.4835 GHz - 490 MHz = 2.2385 Ghz.

2</RTI>
Accordingly, the local oscillator tuning range (third band) is approximately equal to the range 2.155-2.2385 GHz = 83.5 MHz.

Typically, the wider the band of a local oscillator, the longer the switching time. However, in the embodiment of the dual band radio receiver 100 according to the present invention, the narrow band of approximately 83.5 MHz, positioned substantially mid-way between the first and second bands, allows the local oscillator to quickly switch between the first and second bands. The small range of switching (tuning range) of the local oscillator affords quick switching from the first band to the second band thereby providing reception of intermittently transmitted voice and data signals with no loss of information.

Figure 2 illustrates a diagram showing the position of first, second and third frequency bands 202, 204 and 206 respectively, relative to one another in connection with the dual band communication device according to the present invention. First frequency band 202 is utilized for signals that have frequencies in the range 1.910-1930GHz. Second frequency band 206 is utilized for signals that have frequencies in the range 2.40-2.485 GHz. Third frequency band 204, positioned between the first and second frequency bands 202 and 206, includes frequencies in the range 2.155-2.2385.

Figure 3 illustrates a block diagram showing a local oscillator 300 of the dual band radio receiver according to the present invention.

Local oscillator 300 includes a voltage control oscillator (VCO) 304 coupled to a synthesizer 308. The synthesizer 308 includes a frequency setting circuit 310 which sets the frequency of the local oscillator within the third band, which, in the embodiment described herein, is 2.155-2.2385 GHz. A signal output by synthesizer 308 is driven to a low pass filter 306 which processes this signal and further drives this signal to VCO 304. Based on the signal from low pass filter 306 VCO 304 generates a local oscillator signal to the mixer devices shown in Figure 1. A base band controller 312 generates three signals to synthesizer 308: a clock signal (CLK), an enable signal (ENABLE), and a data (DATA) signal. A radio receiver according to the present invention may typically be included in a host circuit which communicates with a transmitter circuit that generates an RF signal, such that the host and the transmitter circuit operate in

handshake with respect to transmission of signals therebetween. The base band 312 thus "knows" at a given moment what is the approximate frequency at which an RF signal is transmitted to the radio receiver and, if this frequency belongs to one of the first and second bands, base band controller 312 switches ON one of the first and second front ends via one of switching devices 126 and 128 respectively.

Figure 4 illustrates a communication system 400 that includes a transmitter 402, that transmits RF signals to a communication device 408 via antenna 406. Communication device 408 includes dual-band radio receiver 410 that is coupled to a digital signal processing circuit (DSP) 412. After theRF signals have been down-converted and demodulated, digital signal processing circuit (DSP) 412 recovers signals and sends these signals by way of microcontroller 414 to a serial port 420, from where digital signals are sent to a PC or workstation 422.

The communication device 410 may include a transceiver (not shown) and a transmittal circuit providing thus a way of transmitting information from the PC or workstation 422 to another radio receiver.

When the communication device 408 is not directly coupled to a PC or workstation, DSP 412 and the microcontroller 414 also provide the necessary intelligence and most of the necessary modem functionality for transmitting data further via telephone or cellular networks. The communication device 408 provides a way to receive data and voice signals intermittently at high frequencies and process these signals very quickly by having a local oscillator like the one described in conjunction with Figure 1 (not shown) switch from one band to another within a reduced time.

Figure 5 illustrates a flow chart diagram in connection with a process for converting a RF signal into an IF signal in a dual band radio receiver configured to receive radio frequency (RF) signals within first and second bands. The process starts as block 500 from where it passes to block 502 where it is determined whether the received RF signal belongs to one of a first and second bands. If theRF signal does not belong to one of the first and second bands the process flows to block 500. If the RF signal belongs to one of the first and second bands, the process passes to block 504 where an IF signal is generated by mixing the RF signal with a local oscillator signal belonging to a third frequency band. The third frequency band is located between the first and second bands. In one embodiment according to the process according to the present invention described in connection with Figure 5, the third band is located approximately midway between said first and second bands. The process then flows back to block 500.

Figure 6 illustrates a process for providing a dual band radio receiver according to the present invention. The process starts at block 602 from where it passes to block 604 where first and second mixers are provided. The process then passes to block 606 where it is provided a circuit configured to determine whether an RF signal input to the circuit belongs to one of the first and second bands. The circuit is configured to couple the RF signal to one of the first and second mixers if it is determined that theRF signal belongs to one of the first and second bands. The process then flows to block 608 where a local oscillator is coupled to the first and second mixers. The local oscillator is configured to generate signals within a third band located between the first and second bands.

While the present invention has been particularly described with reference to the various figures, it should be understood that the figures are for illustration only and should not be taken as limiting the scope of the invention. Many changes and modifications may be made to the invention, by one having ordinary skill in the art, without departing from the spirit and scope of the invention.

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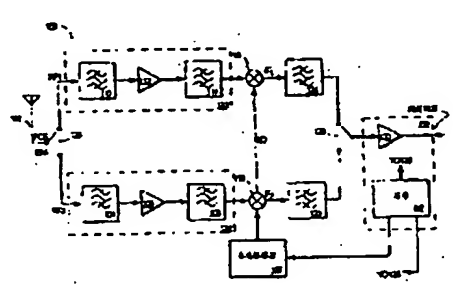
权利要求书 3 页 说明书 6 页 附图页数 6 页

[54]发明名称 双波段无线接收机

[57]摘要

本发明提供了一种双波段无线接收机(100)。该双波段无线接 收机包含一个本地振荡器(122),用来产生本地振荡(LO)信号。它还包含第一混频器(16)和第二混频器(18)。第一混频器用来接 收 LO 信号和包含在第一频带中的 RF 信号。根据这些信号,第一混频 器产生第一 IF 信号。第二混频器用来接收 LO 信号和包含在第二频带 中的第二 RF 信号。根据这些信号,第二混频振荡器产生第二 IF 信号。本地振荡器在介于第一和第二频带之间的第三频带内进行工作。



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权利要求书

1. 一种双波段无线接收机，包含：

本地振荡器，用来产生本地振荡（LO）信号；

第一混频器，用来接收该 LO 信号；和被包括在第一频带内的第一射频（RF）信号，并相应地输出第一中频（IF）信号；

第二混频器，用来接收 LO 信号和被包括在第二频带内的第二射频（RF）信号，并相应地输出第二中频（IF）信号；并且

其中所述本地振荡器工作在介于第一和第二频带间的第三频带内。

2. 权利要求 1 中的双波段无线接收机，其特征在于，还包含第一和第二中频（IF）滤波器和与之相连的切换器件，其中第一和第二 IF 滤波器各自分别连接到第一和第二混频器上。

3. 权利要求 2 中的双波段无线接收机其特征在于，还包含控制电路，此电路连接到本地振荡器及切换器件上。

4. 权利要求 1 中的双波段无线接收机，其特征在于，其中所说的第一频带频率范围基本上为 1.910-1.930GHz.

5. 权利要求 1 中的双波段无线接收机，其特征在于，其中所说的第二频带频率范围基本上为 2.40-2.4835GHz.

6. 权利要求 1 中的双波段无线接收机，其特征在于，其中所说的第三频带频率范围基本上为 2.155-2.2385GHz.

7. 权利要求 1 中的双波段无线接收机，其特征在于，其中所说的第三频带频率大致位于第一和第二频带的中间.

8. 一种系统，包括：

发射机电路；和

与所述发射机电路相连的双波段无线接收机，它包括

本地振荡器，用来产生本振信号；

第一混频器，用来接收该 LO 信号和位于第一频带内的第一 RF 信号并相应的输出第一 IF 信号；

第二混频器，用来接收该 LO 信号和位于第二频带内的第二 RF 信号并相应的输出第二 IF 信号；并且

其中本地振荡器在介于第一和第二频带间的第三频带内工

9. 权利要求 8 中的系统，其特征在于，包含第一和第二 IF 滤波器和与之相连的切换器件；其中第一和第二 IF 滤波器各自分别连接到第一和第二混频器上。

10. 权利要求 9 中的系统，其特征在于，包含控制电路，该电路连接到本地振荡器和切换器件上。

11. 权利要求 8 中的系统，其特征在于，其中所说的第一频带频率范围基本上为 1.910-1.930GHz。

12. 权利要求 8 中的系统，其特征在于，其中所说的第二频带频率范围基本上为 2.40-2.4835GHz。

13. 权利要求 8 中的系统，其特征在于，其中所说的第三频带频率范围基本上为 2.155-2.2385GHz。

14. 权利要求 8 中的系统，其特征在于，其中所说的第三频带频率大致位于第一和第二频带的中间。

15. 在用来接收位于第一和第二频带内的射频（RF）信号的双波段无线接收机中，一种用于将 RF 信号转换为 IF 信号的方法，该方法包含以下步骤：

a) 确定是否 RF 信号属于第一或第二频带；并且

b) 如果 RF 信号属于第一和第二频带两者之一，则通过将所述 RF 信号和一个 LO 信号混频来产生所述 IF 信号，其中该 LO 信号属于介于第一和第二频带之间的第三频带。

16. 权利要求 15 中的方法，其特征在于，其中步骤 b 又包含步骤：

若 RF 信号属于第一频带，则将其与 LO 信号输入到第一混频器中。

17. 权利要求 15 中的方法，其特征在于，其中步骤 b 又包含步骤：

若 RF 信号属于第二频带，则将其与 LO 信号输入到第二混频器中。

18. 权利要求 15 中的方法，其特征在于，第三频带基本上位于第一和第二频带之间。

19. 权利要求 15 中的方法，其特征在于，其中所说的第一频带

20. 权利要求 15 中的方法，其特征在于，其中所说的第二频带频率范围基本上为 2.40-2.4835GHz.

21. 提供双波段无线接收机的方法，该方法包括以下步骤:

提供第一和第二混频器;

提供一种电路用来确定是否输入进来的 RF 信号位于第一或第二频带内，如所述电路确定 RF 信号位于第一或第二频带内，该电路将 RF 信号输至相应的第一或第二混频器; 和

将本地振荡器连接到第一和第二混频器，该本地振荡器用来产生第三频带内的信号，此第三频带大致位于第一和第二频带的正中。

说　明　书

双波段无线接收机

发明领域

本发明涉及通信设备领域．更具体而言，本发明涉及无线接收机。

发明背景

无线接收机在本领域中众所周知，典型地，无线接收机通过连接在其前端的天线接收射频（RF）信号．典型的无线接收机前端包括一个或多个滤波器和接收输入 RF 信号的低噪声放大器．因为在较低频段信号处理复杂性较小，典型地，射频信号在处理前由一个混频器下变频．

混频器接收要进行下变频的 RF 信号和来自本地振荡器（LO）的信号，该信号具有比 RF 信号更低的频率．根据这些信号，混频器产生中频（IF）信号，此中频信号可进一步输入到中频滤波器中，滤波后的中频信号进入解调器、信号处理单元等等．该中频信号的幅度比例于 RF 信号的幅度，并且典型地，其频率低于 RF 信号的频率．在绝大多数无线接收机中，IF 信号的频率比例于 RF 信号与本地振荡器频率之差．

双波段无线接收机是一种用来接收介于两种频率范围（波段）之间信号的接收机．例如，在特定多媒体应用中，像数据和声音信号这样属于两个波段的信号可间歇地传输至双波段无线接收机中．典型的此类应用中的双波段无线接收机需要两个本地振荡器，每个用于一种频带．另外，这种双波段无线接收机可能还需要两个 IF 处理器件，如解调器、放大器、信号处理器等等．这种双波段无线接收机是昂贵的，因为它采用两个本地振荡器和两个中频解调级．

如以较低的价格提供这种双波段无线接收机将是很理想的．若提供的双波段无线接收机允许本地振荡器在两个相对较近的频带间快速切换也是理想的．

发明概要

本发明提供了一种双波段无线接收机．这种双波段无线接收机包

第二两个混频器。第一个混频器用来接收 LO 信号和包含在第一频带中的 RF 信号。对于这些信号，第一混频器产生第 IF 信号。第二混频器用来接收 LO 信号和包含在第二频带中的 RF 信号。根据这些信号，第二混频振荡器产生第二 IF 信号。本地振荡器在介于第一和第二频带之间的第三频带内进行操作。

附图简述

本发明的各特征、各方面和优越性将随着下面的详述、附属的权利要求书、和附图而显得更加全面且清晰。

附图包括:

图 1 为方框图，此图解释了依照本发明的双波段通信设备。

图 2 中的框图显示了与依照本发明的双波段通信设备有关的第一、第二和第三频带位置。

图 3 为方框图，此图显示了与依照本发明的双波段无线接收机有关的本地振荡器。

图 4 显示了一通信系统，该系统包括依照本发明的双波段无线接收机。

图 5 为流程图，此图显示了依照本发明的双波段无线接收机中将 RF 信号转变为 IF 信号的方法。

图 6 显示了提供依照本发明的双波段无线接收机的处理过程。

详述

在下面详述中，各种特定细节均得到了陈述，用来提供对本发明的彻底了解。但是，本领域中的普通技术人员应该清楚，没有这些特定细节，本发明仍旧可以实现。在一些实例中，众所周知的电路、结构与技术并未详细表述，这样可以避免使本发明晦涩难懂。

图 1 为依照本发明的双波段通信设备 100 的方框图。本发明的实施方案在此给予描述。双波段通信设备 100 可以实现为无线接收机，但本发明并非局限在无线接收机领域。双波段无线接收机 100 包含一个天线 102，典型的，该天线用来接收高频段 RF 信号。在此表述的实施方案中，双波段无线接收机 100 接收 PCS 和 ISM 频率范围中传输的信号。在 PCS 频率范围内的信号可用于语声通信（电话），包括大致在 1.910－1.930GHz 范围（此后称之为“第一波段”）内的信号。ISM

2.4835GHz（此后称之为“第二频带”）的信号．但是，依照本发明的双波段无线接收机100并非局限于接收这样两种频带内的信号．

进一步地，双波段无线接收机100包含切换器件126，它连接天线102，并用来连接到第一、第二前端接收机132和134中的一个，这些前端接收机各自单独以虚线表示．切换器件126由基带控制器127控制，依据RF信号是否在第一、第二频带内，它可以选择性地连接天线102接收的RF信号到第一、第二前端接收机132和134其中之一．

前端接收机132和134可以是本领域中熟知的传统前端接收机．第一前端接收机132包括第一带通滤波器110、低噪声放大器112和第二带通滤波器114，但本发明并非局限于这些器件．第一带通滤波器110滤去1.910－1.930GHz之外的频率．低噪声放大器112提供反向隔离，这样可以减少返回到天线102上的辐射，并且提高增益．第二带通滤波器114滤去1.910－1.930GHz之外的频率．第二前端滤波器134包括带通滤波器104和108、以及连接在两者之间的低噪声放大器106．这些器件的工作方式与器件110、112和114基本相同，不同之处在于带通滤波器104和108抑制2.40－2.4835GHz之外的频率．

当RF信号通过第一前端接收机132或第一前端接收机134中的某一个之后，RF信号连接到第一混频器116和第二混频器118其中之一的RF输入端．第一和第二混频器116和118是带有适宜滤波功能的传统混频器．本地振荡器122可能是本领域中众所周知的无线合成电路的组成部分，它连接至第一、第二混频器116和118．本地振荡器122产生本振信号（LO），并将此信号输入到第一和第二混频器116和118的本地振荡器输入端．第一、第二混频器116和118用来将本振信号与输入至混频器116和118之一的各个RF信号混频．因而产生第一、第二中频信号IF1和IF2．

中频信号IF1的频率与RF1信号和LO信号频率之差基本相同，同样的，信号IF2的频率与RF2信号和LO信号频率之差基本相同．然后，产生的第一、第二IF信号各自输入到IF滤波器124和120中，在那里这些信号依据具体接收机设计规范进一步滤波．混频器及其操

接着，第一、第二中频信号 IF1 和 IF2 中的一个会被有选择地通过一个第二切换器件 128 连接到后端电路系统 140（以虚线表示）. 后端电路系统 140 用作放大和解调 IF1 或 IF2 信号. 根据基带控制器 127 产生的控制信号，第二切换器件 128 有选择地连接输入到后端电路 140 的 IF 放大器 130 中的 IF1 或 IF2 中频信号. IF 放大器 130 产生的中频信号将输入到解调器中（未画出）.

本地振荡器 122 用来工作于第三种频带内，此频带介于第一、第二频带之间，它基本上很狭窄（大致 80MHz）. 以这种方式，本地振荡器 122 工作在第一频带的高频端输入和第二频带的低频端输入. 在依照本发明的一种实施方案中，本振器件 122 的频带（第三频带）基本上位于第一、第二频带中心间距的正中，这种设置保证了第一或第二 IF 信号的输出 IF 频带基本上相同，而不论它来自第一或第二频带. 因而，一个本地振荡 IF 单元和解调电路就可以应付属于第一、第二频带的信号. 所以，依照本发明的双波段无线接收机价格较低，因为在此方案中它只需一个本地振荡器和一个后端电路系统.

在此描述的依据本发明的实施方案中，第一频带范围定义在 1.910－1.930GHz 之间，第二频带范围定义在 2.40－2.4835GHz 之间. 本振器 122 工作在第三频带，它高于 1.910－1.930GHz 范围，低于 2.40－2.4835GHz 范围. 本地振荡器工作的第三频带基本上位于第一、第二频带正中. 确定第三频带的频率可用下面的方法计算. 第一、第二频带的最低频率之差为：（2.40GHz-1.910GHz）＝490MHz. 一个包含第三频带下限的较低本振频率可按下式计算:

1.910GHz+(490/2)MHz=2.155GHz

一个包含第三频带上限的较高本振频率可按下式计算:

2.4835-(490/2)MHz=2.2385GHz

依此，本地振荡调谐范围（第三频带）范围大致为 2.155-2.2385GHz=83.5MHz

典型的，本地振荡器频带越宽，切换时间越长. 然而，在依照本发明的双波段无线接收机 100 的实施方案中，一个基本上位于第一、第二频带中间的约 83.5MHz 的窄频带将允许本地振荡器在第一、第二频带间快速切换. 本地振荡器小的切换范围（调谐范围）保证了第一、

数据信号。

图 2 显示了根据本发明的双波段通信设备中第一、第二、以及第三频带 202、204 和 206 各自相对位置。第一频带 202 用于频率范围在 1.910－1.930GHz 间的信号。第二频带 206 用于频率范围在 2.40－2.485GHz 间的信号。第三频带 204 位于第一 202 和第二频带 204 之间，频率范围为 2.155－2.2385GHz。

图 3 显示了依照本发明的双波段接收机中本地振荡器 300 的方框图。本地振荡器 300 包含一个压控振荡器（VCO）304，它连接到一个合成器 308 上。合成器 308 包括一个频率调整电路 310，该电路在第三频带内设定本地振荡器的频率，此频带在本方案中是 2.155－2.2385GHz。合成器 308 的信号输出到低通滤波器 306 中，低通滤波器 306 处理该信号后便将其进一步输出到 VCO304 中。基于来自低通滤波器 306 的信号，VC304 产生一个本振信号并将其输出至图 1 中的混频器中。基带控制器 312 产生三个信号并输出至合成器 308：一个时钟信号（CLK）、一个允许信号（ENABLE（允许））、以及一个数据信号（DATA 数据）。根据本发明的无线接收机一般被包括于一个主电路中，该主电路与产生 RF 信号的发射机电路通信，因此对于两者间信号的传送，主电路与发射机电路以握手方式进行操作。于是，基带 312 在一给定时刻“知晓”RF 信号发送到无线接收机采用的适宜频率，若此频率位于第一或第二频带内，则基带控制器 312 通过相应的切换器件 126 和 128 接通第一或第二前端。

图 4 显示了通信系统 400，它包括一个发射机 402，该发射机通过天线 406 将 RF 信号发射至通信设备 408。通信设备 408 包括双波段接收机 410，后者连接到一数字信号处理电路（DSP）412 上。在 RF 信号下变频并解调后，数字信号处理电路（DSP）412 恢复该信号并将其通过微控制器 414 传送到串行接口 420，由此数字信号发往 PC 或工作站 422。通信设备 410 可以包括一发射接收机（未画出）和一发送电路，以使 PC 或工作站 422 可以将信息发送到另一无线接收机。当通信设备 408 未直接连接至 PC 或工作站时，DSP412 和微控制器 414 也提供必要的智能和绝大多数必要的调制解调功能，以便将数据进一步经电话或蜂窝网络进行传送。通信设备 408 提供了在高频段接收间

在较短时间内从一个频带转换至另个种频带从而快速处理这些信号.

图 5 显示一流程图，该图与将 RF 信号转换为 IF 信号的处理过程有关，该过程发生在接收位于第一、第二频带内的 RF 信号的双波段无线接收机中. 处理过程由方框 500 开始，由此进入到方框 502，在 502 中确定接收的 RF 信号是否属于第一或第二频带. 若 RF 信号不属于第一或第二频带，处理转回至方框图 500. 若 RF 信号属于第一或第二频带，处理进入方框图 504，在 504 中 RF 信号与属于第三频带的本振信号混频产生中频信号. 第三频带位于第一、第二频带之间. 依据本发明在图 5 中描述的处理过程的一种实施方案，第三频带大致位于第一、第二频带正中. 然后，处理转回方框图 500.

图 6 显示了用于提供根据本发明的双波段无线接收机的过程. 该方法由方框 602 开始，然后进入到方框 604，在 604 中提供了第一、第二混频器. 接着，进入方框 606，在 606 中配置了一种电路来确定其所接收的输入 RF 信号是否位于第一或第二频带内. 若确定了 RF 信号位于第一或第二频带，那么此电路就将 RF 信号连接到第一或第二混频器上. 然后进入方框 608，在 608 中本地振荡器连接第一和第二混频器. 本地振荡器用来产生介于第一和第二频带间的第三频带中的信号.

虽然参考以上各图具体描述了本发明，但我们应该清楚，这些图只是用于说明而不应视为本发明范围的限制. 本领域的普通技术人员在不违背本发明宗旨和范围的前提下，可以对于本发明进行各种变动和修改.

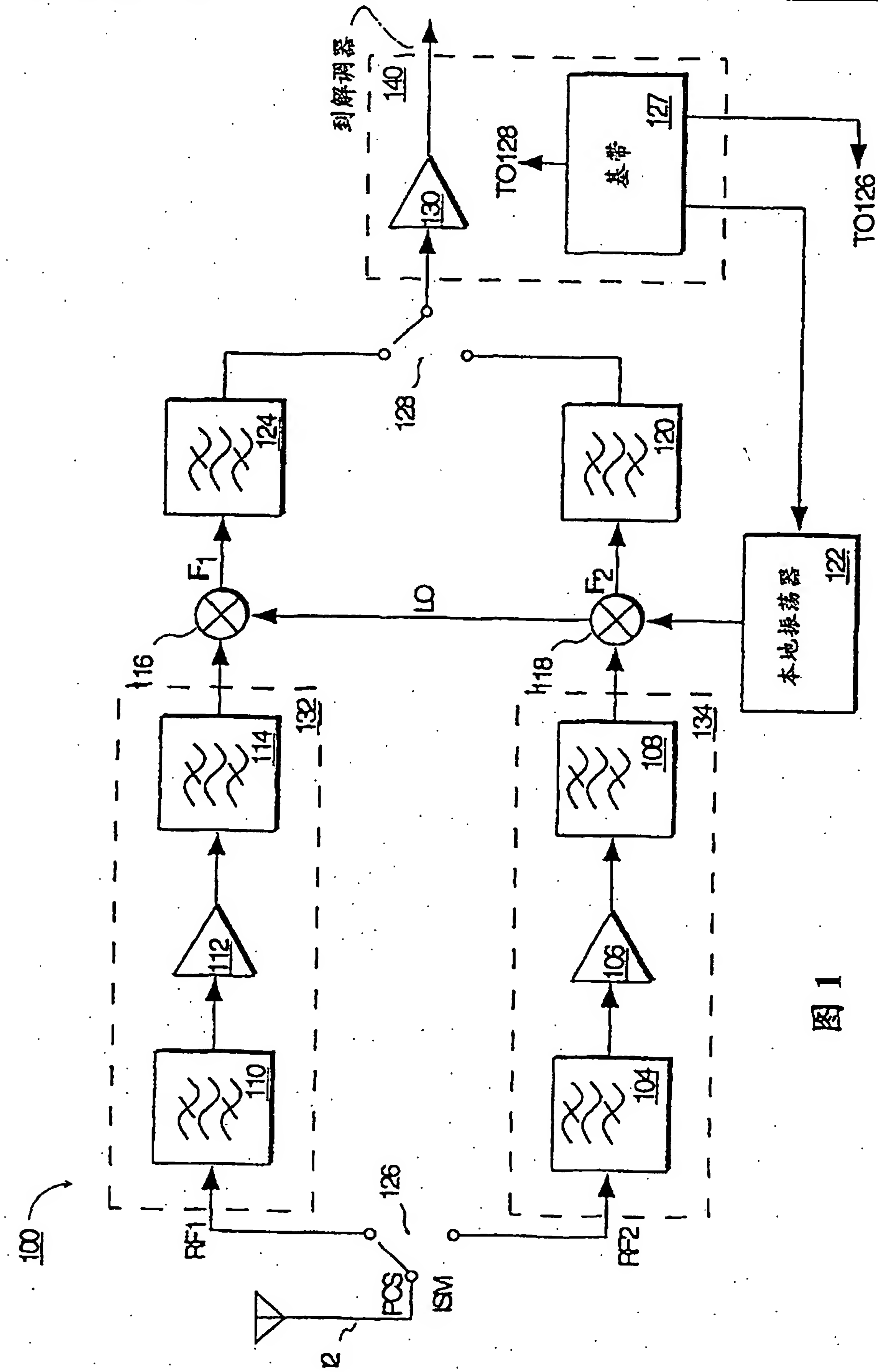
到解调器
140
130
基带
127
TO128
TO126
128
124
120
F1
F2
LO
本地振荡器
122
116
118
132
134
114
112
110
108
106
104
126
RF1
RF2
PCS
ISM
100
12

图 1

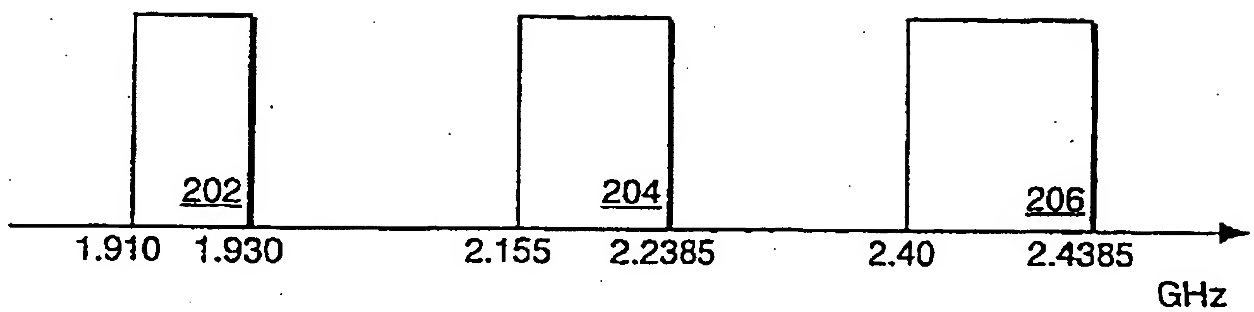

图 2

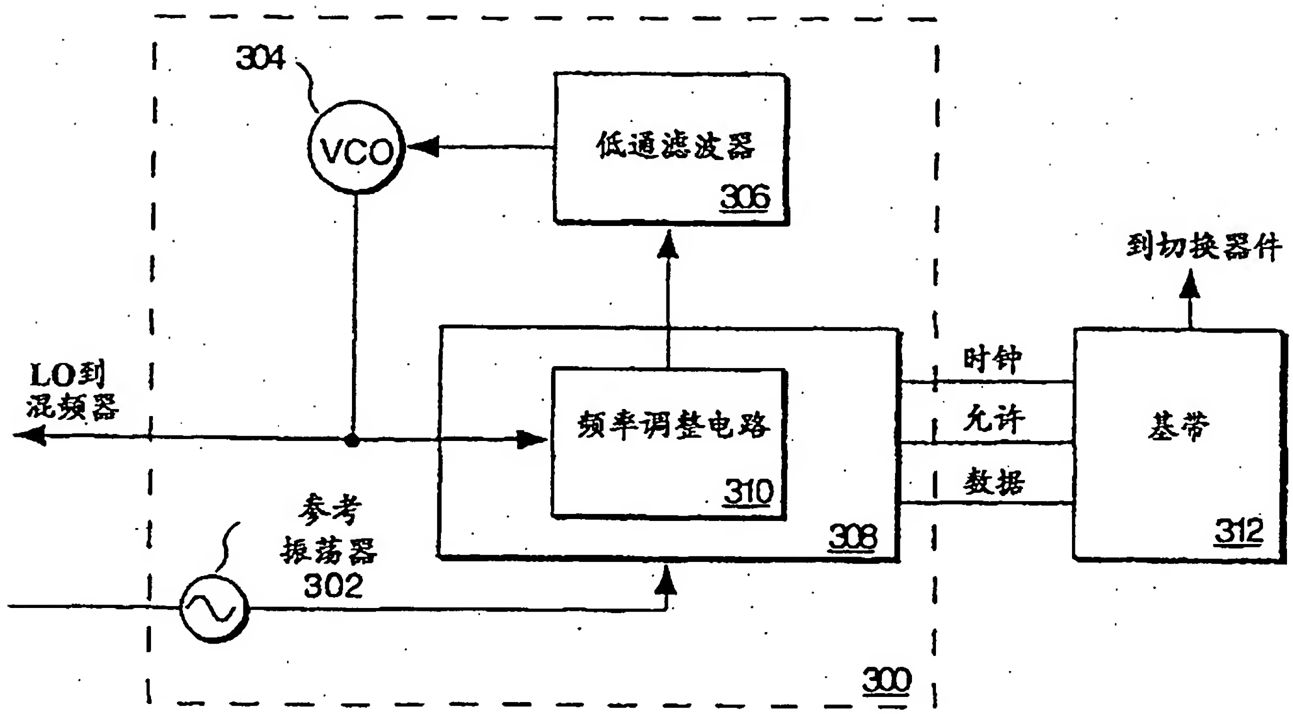
304
VCO
低通滤波器
306
到切换器件
LO到
混频器
频率调整电路
310
308
时钟
允许
数据
基带
312
参考
振荡器
302
300

图 3

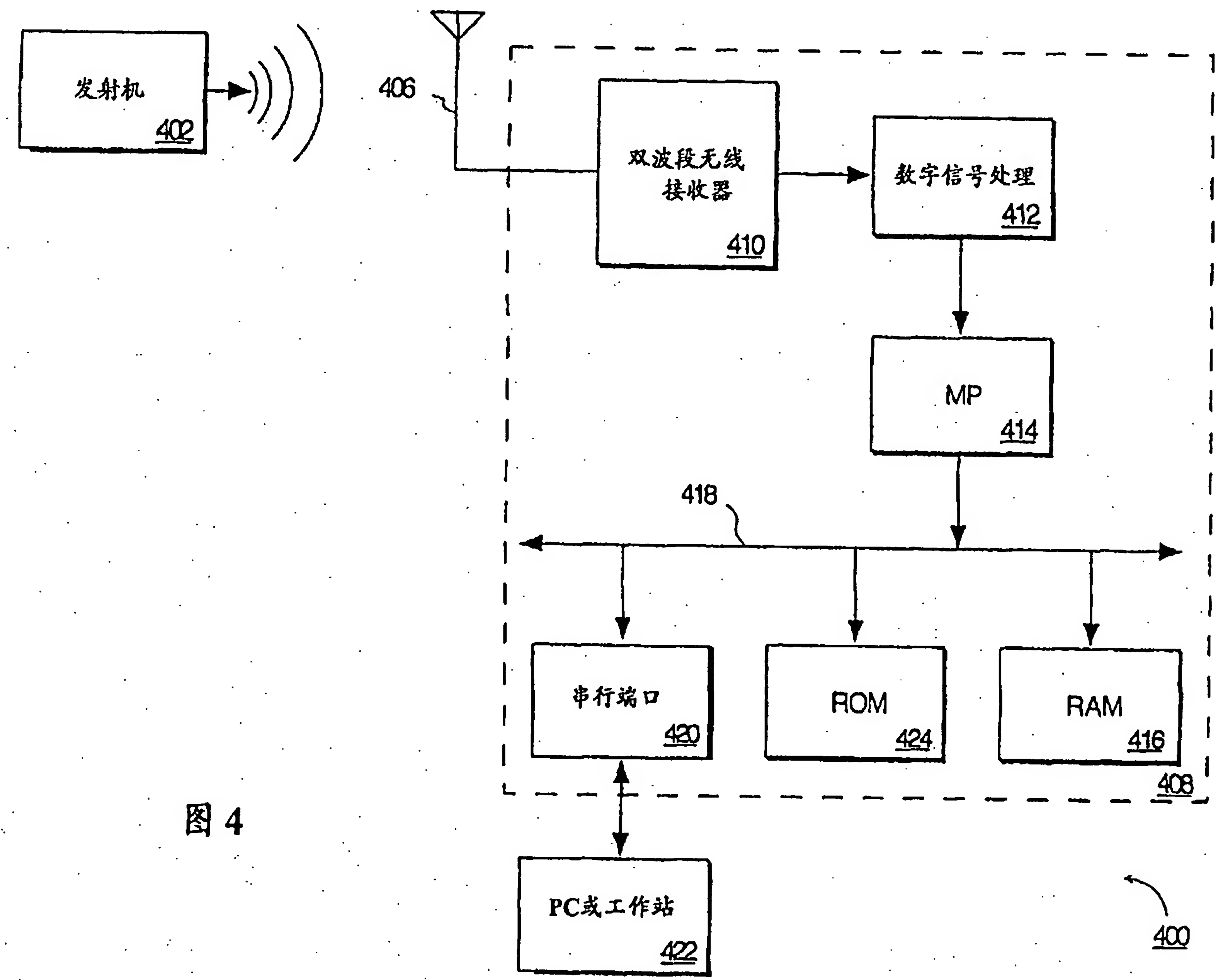
发射机
402
406
双波段无线接收器
410
数字信号处理
412
MP
414
418
串行端口
420
ROM
424
RAM
416
408
PC或工作站
422
400

图 4

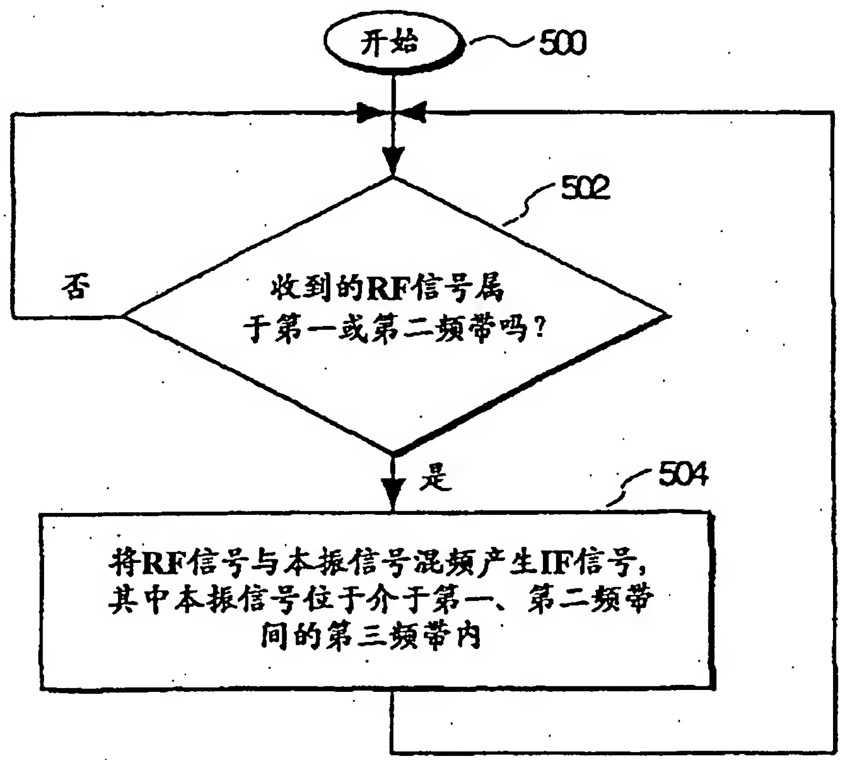
开始
500
502
收到的RF信号属于第一或第二频带吗？
否
是
504
将RF信号与本振信号混频产生IF信号，其中本振信号位于介于第一、第二频带间的第三频带内

图 5

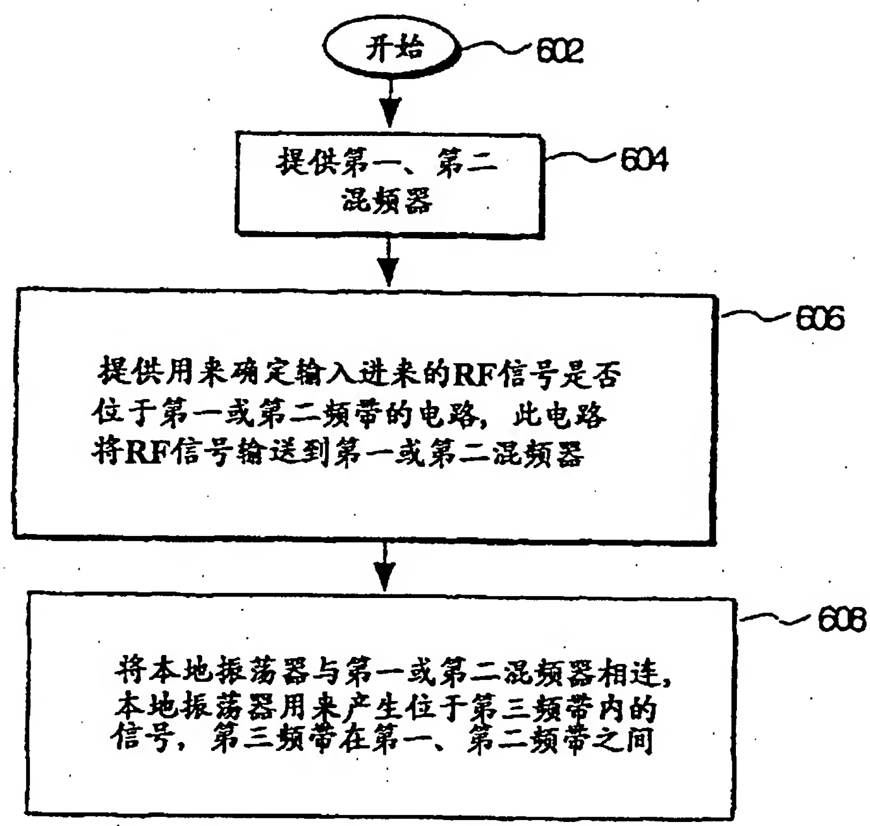
开始
602
提供第一、第二混频器
604
提供用来确定输入进来的RF信号是否位于第一或第二频带的电路，此电路将RF信号输送到第一或第二混频器
606
将本地振荡器与第一或第二混频器相连，本地振荡器用来产生位于第三频带内的信号，第三频带在第一、第二频带之间
608

图 6